* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1]A lighting system comprising:
A light source using one or more light emitting diodes which emit light irradiated by illumination part.
An illumination entropy optical element for carrying out entropy of the illumination in said illumination part of light emitted from this light source.

[Claim 2]The lighting system according to claim 1 which said illumination entropy optical elements are one or more rod type light integrators, and is characterized by said light emitting diode being joined by end surface of said rod type light integrator so that the light-emitting surface may counter an end surface of said rod type light integrator.
[Claim 3]The lighting system according to claim 1 which said illumination entropy optical element is a fly eye lens, and is characterized by arranging said light emitting diode so that the light-emitting surface may counter an end surface of said fly eye lens.
[Claim 4]The lighting system according to claim 1, wherein two or more said light emitting diodes are formed so that each light-emitting surface may be arranged superficially, and each luminescence intensity is controlled independently.
[Claim 5]The lighting system according to claim 1 since said light source is constituted [a color picture], wherein it contains two or more light emitting diodes which emit light of a mutually different wavelength area.
[Claim 6]A graphic display device comprising:
A space modulation means which modulates light irradiated spatially according to information on an image to display, and forms a picture.
A light source using one or more light emitting diodes which emit light irradiated by this space modulation means.
An illumination entropy optical element for carrying out entropy of the illumination in said space modulation means of light emitted from this light source.
A projection optical system which projects light modulated by said space modulation means.

[Claim 7]Said illumination entropy optical elements are one or more rod type light integrators, and said light emitting diode, The graphic display device according to claim 6 characterized by being joined by end surface of said rod type light integrator so that the light-emitting surface may counter an end surface of said rod type light integrator.
[Claim 8]The graphic display device according to claim 6 which said illumination entropy optical element is a fly eye lens, and is characterized by arranging said light emitting diode so that the light-emitting surface may counter an end surface of said fly eye lens.
[Claim 9]The graphic display device according to claim 6, wherein two or more said light emitting diodes are formed so that each light-emitting surface may be arranged superficially, and each luminescence intensity is controlled independently.
[Claim 10]The graphic display device according to claim 6 since said light source is constituted [a color picture], wherein it contains two or more light emitting diodes which emit light of a mutually different wavelength area.
[Claim 11]The graphic display device according to claim 10 having a driving means which drives said two or more light emitting diodes so that light of a mutually different wavelength area may be emitted one by one with a predetermined cycle.
[Claim 12]The graphic display device according to claim 6 which said illumination entropy optical elements are one or more rod type light integrators, and is characterized by forming the end face by the side of outgoing radiation of this rod type light integrator in shape corresponding to an image formation area in said space modulation means.

[Translation done.]

* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]This invention relates to the lighting system for performing uniform lighting, and the graphic display device which displays an image by modulating the light from this lighting system spatially, and projecting on a screen etc.
[0002]
[Description of the Prior Art]The light emitted from the light source is spatially modulated by video display light valves as a graphic display device conventionally used for the purpose of appreciating an image, and there is a projected type graphic display device which projects an image on a screen etc. There is a liquid crystal projector using a transmission type liquid crystal panel in one of the projected type graphic display device of this as video display light valves, and it is put in practical use from having a small light weight.
[0003]In the conventional liquid crystal projector, the white light source of a discharged type xenon lamp, a metal halide lamp, or a thermoluminescence type halogen lamp is used as a light source, An unnecessary light is removed with UV-IR cut filter in which the white light emitted from this light source cuts ultraviolet rays (UV) and infrared rays (IR), It is separated into a trichromatic light red (R is described hereafter.), green (G is described hereafter.), and blue (B is described hereafter.) by the dichroic mirror etc. which are made to penetrate or reflect the light of a specific wavelength component. Each separated light the liquid crystal panel of three sheets as a spatial optical modulation part in which the picture was formed according to each signal corresponding to the three primary colors, respectively After passage, It is compounded by the synthetic light study system, and is considered as a full color picture, and extended projection is carried out to the screen of a front transmission type or reflection type with a projector lens.
[0004]
[Problem(s) to be Solved by the Invention]By the way, with the projected type graphic display device using lamps, such as a xenon lamp, a metal halide lamp, and a halogen lamp, as mentioned above. The power consumption of the lamp was large, and in order to raise efficiency for light utilization, the size of a device also had the problem of becoming large, by using many optics. There was a problem that exchange of a lamp was frequently needed, from aging of a lamp of a luminosity being large and it being comparatively short-life.
[0005]In the conventional projected type graphic display device, since wavelength distribution existed in the emitted light of a lamp, there was a problem that the wavelength distribution of each color which carried out color separation was difficult for good color reproduction depending on the wavelength distribution of the emitted light of a lamp.
[0006]In projected type graphic display devices, such as a liquid crystal projector, improvement and equalization of display luminance have been SUBJECT. The entropy of the illumination of the illumination light to video display light valves is needed for equalization of display luminance. However, in the usual liquid crystal projector. For example, since synchrotron radiation of a metal halide lamp is made parallel with a parabolic reflector and it irradiates with a liquid crystal panel directly, In the display screen, the irregular color resulting from the luminescence unevenness of a lamp arose, and the center portion of the display screen became quite bright compared with the peripheral part, and there was a problem that display quality was inferior compared with the image in the case of facing CRT (cathode-ray tube) squarely.
[0007]Improvement in efficiency for light utilization and improvement of a lamp are needed for improvement in display luminance. In the present level, the utilization efficiency of light is only several percent, and makes most lights useless. Therefore, if this is improved, display luminance will improve and power consumption will also decline. These days, development of a lamp with high luminous efficiency of the point light source which is easy to take out a parallel beam is performed, using a high-output lamp (a xenon lamp, a metal halide lamp), in order to secure a luminosity. However, when the luminous efficiency of a lamp is raised, there is a problem that the

reciprocity relation that current becomes large and a life becomes short exists. On the other hand, since spectral distribution exists in the emitted light of a lamp about the utilization efficiency of light, there is a problem that the quantity of the light thrown away when carrying out color separation to the three primary colors of required R, G, and B exists mostly.

[0008]In the conventional projected type graphic display device, in order to obtain a required luminosity from the utilization efficiency of light being low, the big lamp had to be used and, as a result, there was a problem that a projected type graphic display device was enlarged.

[0009]This invention was made in view of this problem, the 1st purpose has a long life of a lamp, it can improve the utilization efficiency of light, and reduction of power consumption and the miniaturization of a device are enabled, and it is in providing the uniform lighting system of illuminance distribution.

[0010]A life of a lamp is long, can improve the utilization efficiency of light, enables reduction of power consumption, and the miniaturization of a device, and makes good color reproduction possible, and the 2nd purpose of this invention is to provide a graphic display device with uniform display luminance.

[0011]

[Means for Solving the Problem]The lighting system according to claim 1 is provided with a light source using one or more light emitting diodes which emit light irradiated by illumination part, and an illumination entropy optical element for carrying out entropy of the illumination in an illumination part of light emitted from this light source.

[0012]The graphic display device according to claim 6 is spatially modulated according to information on an image which displays light irradiated, A space modulation means which forms a picture, and a light source using one or more light emitting diodes which emit light irradiated by this space modulation means, It has an illumination entropy optical element for carrying out entropy of the illumination in a space modulation means of light emitted from this light source, and a projection optical system which projects light modulated by space modulation means.

[0013]In the lighting system according to claim 1, light emitted from a light source which used one or more light emitting diodes is irradiated by illumination part so that entropy of the illumination in an illumination part may be carried out by illumination entropy optical element.

[0014]Light emitted in the graphic display device according to claim 6 from a light source which used one or more light emitting diodes, A space modulation means glares so that entropy of the illumination in a space modulation means may be carried out by illumination entropy optical element, and according to information on an image displayed by this space modulation means, it becomes irregular spatially, and is projected by a projection optical system.

[0015]

[Embodiment of the Invention]Hereafter, an embodiment of the invention is described in detail with reference to drawings. Drawing 1 is a perspective view showing the composition of the lighting system concerning a 1st embodiment of this invention. The lighting system concerning this embodiment is provided with the following.

The one light emitting diode 11 as a light source which emits the light irradiated by the illumination part.

The rod type light integrator (henceforth the kaleidoscope (KALEIDOSCOPE)) 12 as an illumination entropy optical element for carrying out entropy of the illumination in the illumination part of the light emitted from this light emitting diode 11.

The kaleidoscope 12 consists of a glass rod with a certain amount of length, carries out entropy of the light which entered from the end surface (incident end face), and emits it from an other end face (emitting end surface). If square pole form, the shape of a hexagonal prism, etc. are pillar-shaped, they are good, but this kaleidoscope 12 is made into square pole form in the example shown in drawing 1. The light emitting diode 11 is joined by the incident end face of the kaleidoscope 12 so that the light-emitting surface may counter the incident end face of the kaleidoscope 12. In the lighting system shown in drawing 1, although the shape of the incident end face of the kaleidoscope 12 and the light emitting diode 11 of the approximately same shape and the size were used, as shown in drawing 2, the light emitting diode 11 smaller than the shape of an incident end face may be used by the shape and similar figures of an incident end face of the kaleidoscope 12.

[0016]Here, with reference to drawing 5, the principle of the illumination entropy in the kaleidoscope 12 is explained. In the kaleidoscope 12, the light which entered with the angle to the optic axis 13 in the incident end face 12a repeats total internal reflection on the side of the kaleidoscope 12, and is emitted from the emitting end surface 12b. The light from which reflecting times differ with the degree of incidence angle to the kaleidoscope 12, and reflecting times differ as a result here is mixed, and it becomes uniform emitted light in the emitting end surface 12b (refer to the 41-44th page" in literature " "opto-electronics contact" and Vol.33 No 2-1995 years.).

[0017]The lighting system concerning this embodiment can be used for the device which needs uniform illumination in an illumination part, for example, a projected type graphic display device. In this application here with a projected type graphic display device. Besides the device projected on a screen, the light spatially

modulated like the liquid crystal projector, An image display [which projects the light spatially modulated like the head mount display on human being's eyes] type graphic display device, and the exposure device which projects the light further modulated spatially like the stepping projection aligner on the resist on a semiconductor wafer shall also be included.

[0018]When using the lighting system concerning this embodiment for the projected type graphic display device for appreciation, what emits visible light is used as the light emitting diode 11. When using the lighting system concerning this embodiment for an exposure device, what the illumination light does not need to be visible light, and ultraviolet radiation etc. may be sufficient as, and emits the light of required wavelength areas, such as ultraviolet radiation, as the light emitting diode 11 in this case is used.

[0019]When using the lighting system concerning this embodiment for the full color projected type graphic display device for appreciation, using the three primary colors of R, G, and B as illumination light sees from the field of color reproduction nature, and it is the most effective. So, the following explanation explains the case where the three primary colors of R, G, and B are used as illumination light.

[0020]As an object for red light, what used the AlGaPAs system compound semiconductor is used for the light emitting diode 11, for example, and the thing using the GaN system or the ZnSe system compound semiconductor as the object for green emission and an object for blue light is used for it, for example.

[0021]The light emitting diode 11 is used in the so-called form of a bare chip. Although the size of the light-emitting surface of the light emitting diode marketed is a size of 0.2 - 0.5 mm square, now, In using the lighting system concerning this embodiment for the projected type graphic display device for appreciation, the external quantum efficiency of a compound semiconductor, etc. change with materials, but. As the light emitting diode 11 in this embodiment, the thing of the size about several millimeter angle shall be preferred, and shall produce and use the bare chip of such a size by this embodiment.

[0022]Although a quadrangle, a hexagon, a round shape of the shape of the light-emitting surface of the light emitting diode 11 and the section of the kaleidoscope 12, etc. are arbitrary, for example, When [both] using the lighting system concerning this embodiment for the projected type graphic display device for appreciation, it is preferred to consider it as the shape of the image display area of the light valve used as an illumination part and similar figures. By considering it as such shape, the light which could make sectional shape of the light flux irradiated by the image display area of a light valve the shape corresponding to an image display area, and was emitted from the light emitting diode 11 as a result will be used effectively, and the utilization efficiency of light improves. As emitted light from the kaleidoscope 12, the highest luminosity and efficiency are obtained by considering it as the same shape as abbreviation of the light-emitting surface of the light emitting diode 11, and the section of the kaleidoscope 12. Therefore, for example, in making shape of the image display area of a light valve into the same aspect ratio 3:4 as the present monitor. The shape of the light-emitting surface of the light emitting diode 11 and the section of the kaleidoscope 12 is also formed in the aspect ratio 3:4, When making shape of the image display area of a light valve into the same aspect ratio 9:16 as Hi-Vision, it is preferred to also form the shape of the light-emitting surface of the light emitting diode 11 and the section of the kaleidoscope 12 in the aspect ratio 9:16.

[0023]The construction material of the kaleidoscope 12 is optical glass. Although the length of the kaleidoscope 12 turns into length in consideration of the number of times of the total internal reflection of light, tens of mm - about hundreds of mm are preferred.

[0024]Next, with reference to drawing 3 and drawing 4, the example of the joining method of the light emitting diode 11 and the kaleidoscope 12 in the lighting system concerning this embodiment is explained. Drawing 3 and drawing 4 are the sectional views showing the joining section of the light emitting diode 11 and the kaleidoscope 12. In the example shown in drawing 3, with the light-emitting surface of the light emitting diode 11, the reflector 15 which served as the electrode of shape which makes a part of surface of a sphere is formed, and the leads 16 and 17 are connected to the light-emitting surface and the reflector 15 of the light emitting diode 11 at the field side of an opposite hand, respectively. After mounting the bare chip of the light emitting diode 11 of several millimeter angle to the reflector 15 and performing electrode wiring in this example, for example, so that the light-emitting surface of the light emitting diode 11 may counter the incident end face of the kaleidoscope 12, The light emitting diode 11 and the reflector 15 are joined to the incident end face of the kaleidoscope 12. The mount art of the light emitting diode marketed by the general present can be used for mount of the bare chip of the light emitting diode 11.

[0025]In the example shown in drawing 4, the metal reflection film 19 is formed in the field of an opposite hand, and the leads 16 and 17 are connected with the light-emitting surface of the light emitting diode 11 in the light-emitting surface and the field of an opposite hand of the light emitting diode 11, respectively. After giving formation and wiring of the metal reflection film 19 to the bare chip of the light emitting diode 11 formed in the predetermined size in this example, for example, It has arranged so that a light-emitting surface may counter the

incident end face of the kaleidoscope 12, and it has joined to the incident end face of the kaleidoscope 12 directly by the epoxy resin 18 grade.

[0026]Next, an operation of the lighting system concerning this embodiment is explained. In the lighting system concerning this embodiment, from an incident end face, the light emitted from the light emitting diode 11 enters into kaleidoscope 12 inside, repeats total internal reflection on the side of the kaleidoscope 12, turns into emitted light more uniform than an emitting end surface, and is emitted. This emitted light is uniformly irradiated by illumination parts, such as an image display area of a light valve.

[0027]Since the light emitting diode 11 was used as a light source according to the lighting system concerning this embodiment, a life of a lamp becomes long. Therefore, the time and effort of exchange of a light source can be reduced.

[0028]When using the lighting system concerning this embodiment for the full color projected type graphic display device for appreciation, the light thrown away when carrying out color separation like [in the case of using a white light source as a light source] is lost, and the utilization efficiency of light can be improved. as a result, power consumption can be lessened compared with the case where a white light source is used as a light source -- the miniaturization of a graphic display device is both attained.

[0029]By the way, although the above effects are acquired by using the light emitting diode 11 as a light source, Since the polar zone exists in the light-emitting surface side of the light emitting diode 11 in part, a difference may arise in the size of current density in a light-emitting surface, and, as a result, luminosity unevenness may arise in the emitted light of the light emitting diode 11. As a result, as it is, when unevenness arises in the illuminance distribution in an illumination part and a lighting system is used for an appreciated type graphic display device, luminosity unevenness and an irregular color may be produced in the image displayed. However, in the lighting system concerning this embodiment, since entropy of illumination is attained for the emitted light of the light emitting diode 11 through the kaleidoscope 12, entropy of the illuminance distribution in an illumination part can be carried out, and the above-mentioned fault can be canceled.

[0030]In using the lighting system concerning this embodiment for the full color projected type graphic display device for appreciation, The wavelength distribution of each color is not dependent on the wavelength distribution of the emitted light of the original white light source like [since the wavelength area of the emitted light of the light emitting diode for every color is narrow / at the time of carrying out color separation of the emitted light of a white light source], The range of the color which can be expressed by composition of the emitted light of the light emitting diode for every color becomes large, and, as a result, good color reproduction becomes possible.

[0031]Drawing 6 is a perspective view showing the composition of the lighting system concerning a 2nd embodiment of this invention. The lighting system concerning this embodiment is the example which formed two or more light emitting diodes 11 so that each light-emitting surface might be superficially arranged to the incident end face of the one kaleidoscope 12 as a light source. In the example shown in drawing 6, to the incident end face of the kaleidoscope 12, three rows long and three rows wide were used, a total of nine light emitting diodes 11 have been arranged, and it has joined. The shape of each light emitting diode 11 is the shape and similar figures of an incident end face of the kaleidoscope 12. The shape of the whole aggregate of the nine light emitting diodes 11 is the same as that of the shape of the light emitting diode 11 in the lighting system shown in drawing 1, and abbreviation.

[0032]In the lighting system concerning a 1st embodiment, since the one light emitting diode 11 is used as a light source, when luminosity high as a lighting system is required, it is necessary to use the very high-intensity light emitting diode 11 but, and. In the lighting system concerning this embodiment, since two or more light emitting diodes 11 are used as a light source, compared with a 1st embodiment, the light emitting diode 11 with low luminosity can be used, and an equivalent lighting system can be realized. According to the lighting system concerning this embodiment, compared with a 1st embodiment, it also becomes possible to realize a higher-intensity lighting system. According to the lighting system concerning this embodiment, it becomes possible using many light emitting diodes 11 to obtain the illumination light of arbitrary intensity distribution by making them emit light selectively by setting up the shape of a light-emitting surface arbitrarily, or changing the luminescence intensity for every light emitting diode 11. The composition of others in this embodiment, the operation, and the effect are the same as that of a 1st embodiment.

[0033]Drawing 7 is a perspective view showing the composition of the lighting system concerning a 3rd embodiment of this invention. Two or more things which joined the one light emitting diode 11 are bundled to the incident end face of the one kaleidoscope 12, and the lighting system concerning this embodiment constitutes them in it. In the example shown in drawing 7, the kaleidoscope 12 which joined the light emitting diode 11 to the incident end face was made into three rows long and three rows wide, and is bundled a total of nine. The shape of each light emitting diode 11 is the shape and similar figures of an incident end face of each kaleidoscope 12. Two or more kaleidoscopes 12 are bundled by pasting together with an epoxy resin etc., for example. The shape of the

whole lighting system concerning this embodiment becomes being the same as that of the lighting system concerning a 2nd embodiment shown in drawing 6. The composition of others in this embodiment, the operation, and the effect are the same as that of a 2nd embodiment.

[0034]Drawing 8 is a perspective view showing the composition of the lighting system concerning a 4th embodiment of this invention. Two or more things which joined two or more light emitting diodes 11 to the incident end face of the one kaleidoscope 12 are bundled, and the lighting system concerning this embodiment constitutes them. In the example shown in drawing 8, to the incident end face, the kaleidoscope 12 which used two rows long and three rows wide, and joined a total of six light emitting diodes 11 was made into three rows long and three rows wide, and is bundled a total of nine. Two or more kaleidoscopes 12 are bundled by pasting together with an epoxy resin etc., for example. The composition of others in this embodiment, the operation, and the effect are the same as that of a 2nd embodiment.

[0035]Here, two or more light emitting diodes 11 are superficially arranged like the 2nd thru/or a 4th embodiment, and the effect by controlling independently the luminescence intensity of each light emitting diode 11 is explained with reference to drawing 9 thru/or drawing 11. Drawing 9 and drawing 10 show the result of the experiment which investigated the relation between the luminescent state of a light source, and the illumination state at the time of irradiating an illumination part with the light emitted from the light source through a predetermined optical system.

[0036]In drawing 9, the luminescent state at the time of (a) making shape of the light-emitting surface of a light source the rectangle of the aspect ratio 3:4, and making it emit light uniformly in a light-emitting surface is expressed, and (b) expresses the illumination state which can be set in that case. (c) makes shape of the light-emitting surface of a light source the rectangle of the aspect ratio 3:4, the luminescent state at the time of giving distribution to luminescence intensity in a light-emitting surface is expressed, and (d) expresses the illumination state which can be set in that case. In (a), the numerals A0 express the field of uniform luminosity. In (b), luminosity the numerals A1 with a relative value Or more 1.3 less than 1.4 field, A2 -- luminosity -- a relative value -- 1.2 or more fields [less than 1.3] and A3 -- luminosity -- a relative value -- 1.1 or more fields [less than 1.2] and A4 -- as for 1.0 or more fields [less than 1.1] and A5, in luminosity, luminosity expresses the or more 0.9 less than 1.0 field with the relative value with the relative value. In (b) and (d), illumination the numerals B1 with a relative value Or more 0.9 one or less field, B-2 -- illumination -- a relative value -- 0.8 or more fields [less than 0.9] and B3 -- illumination -- a relative value -- 0.7 or more fields [less than 0.8] and B4 -- as for 0.3 or more fields [less than 0.7] and B5, in illumination, illumination expresses the or more 0.1 less than 0.3 field with the relative value with the relative value. In the example shown in drawing 9 (c), distribution of luminescence intensity is changed in the right half and left half within a light-emitting surface. That is, in the left half, luminosity is gently enlarged towards the circumference, and, in the right half, luminosity is suddenly enlarged by a periphery, and the maximum of the luminosity in a right half is made larger than the maximum of the luminosity in a left half.

[0037]Similarly, in drawing 10, the luminescent state at the time of (a) making shape of the light-emitting surface of a light source the rectangle of the aspect ratio 9:16, and making it emit light uniformly in a light-emitting surface is expressed, and (b) expresses the illumination state which can be set in that case. (c) makes shape of the light-emitting surface of a light source the rectangle of the aspect ratio 9:16, the luminescent state at the time of giving distribution to luminescence intensity in a light-emitting surface is expressed, and (d) expresses the illumination state which can be set in that case. In these figures, the meaning of the numerals A0 - A5, B1 - B5 is the same as that of the case of drawing 9. In the example shown in drawing 10 (c), distribution of luminescence intensity is changed in the right half and left half within a light-emitting surface. That is, in the left half, luminosity is gently enlarged towards the circumference, and, in the right half, luminosity is suddenly enlarged by a periphery, and the maximum of the luminosity in a right half is made larger than the maximum of the luminosity in a left half.

[0038]When light is made to emit uniformly in a light-emitting surface in a light source from drawing 9 (a), (b), and drawing 10 (a) and (b) so that it may understand, in an illumination part, a peripheral part becomes dark compared with a center portion. Then, by giving distribution to the luminescence intensity of a light source, as shown in drawing 9 (c) and drawing 10 (c), as shown in drawing 9 (d) and drawing 10 (d), it becomes possible to lessen unevenness of the luminosity in an illumination part.

[0039]As for the luminescent state of a light source, since the relation between the luminescent state of a light source and the illumination state in an illumination part changes with optical systems between a light source and an illumination part, etc., it is preferred to set up suitably according to each device with which the lighting system concerning the 2nd thru/or a 4th embodiment is used. Here, the case where the lighting system concerning the 2nd thru/or a 4th embodiment is used for the projected type graphic display device for appreciation with reference to drawing 11 is considered. In drawing 11, (a) and (c) express the luminescent state of a light source, and (b) and (d) express the example of the illuminance distribution at horizontal one line in the center section of the sliding direction in video display light valves in case luminescent states are (a) and (c), respectively. In the

example shown in drawing 11, as shown in (a), the light emitting diode 11 Six rows long. When [which is made into ten rows wide] a total of 60 pieces are arranged, a light source is constituted and each light emitting diode 11 is made to emit light uniformly, as the illuminance distribution on video display light valves was shown in (b), in illumination, illumination shall become gradually small towards the circumference greatly by a center portion. In such a case, ideally, as shown in (c), as shown in (d), it becomes possible by enlarging luminescence intensity of the light emitting diode 11 gradually towards the circumference from a center portion to consider it as flat illuminance distribution.

[0040]Drawing 12 is a perspective view showing the composition of the lighting system concerning a 5th embodiment of this invention. To the incident end face of the one kaleidoscope 12, the lighting system concerning this embodiment arranges two or more red light diodes 11R, green light emitting diodes 11G, and blue light-emitting diodes 11B every, respectively, and is joined. The methods of the arrangement of each light emitting diodes 11R, 11G, and 11B include a mosaic array as shown in drawing 13, delta arrangement as shown in drawing 14, etc.

[0041]In the lighting system concerning this embodiment, illumination can obtain the white illumination light by which entropy was carried out by making each light emitting diodes 11R, 11G, and 11B turn on simultaneously. In the lighting system concerning this embodiment, the trichromatic illumination light of R, G, and B which entropy of the illumination is carried out, respectively and are outputted one by one can be obtained by making each light emitting diodes 11R, 11G, and 11B turn on one by one. And the display of the color picture by a time sharing color specification method which is mentioned later is attained using the trichromatic illumination light of this R, G, and B. The composition of others in this embodiment, the operation, and the effect are the same as that of a 2nd embodiment.

[0042]Drawing 15 is an explanatory view showing the composition of the graphic display device concerning a 6th embodiment of this invention. This graphic display device is provided with the following.

The synthetic prism 20 of cube shape.

Video display light valves 21G for green allocated so that the one field 20G of this synthetic prism 20 might be countered.

Video display light valves 21R for red allocated so that other fields 20R which intersect perpendicularly with the field 20G in the synthetic prism 20 might be countered.

Video display light valves 21B for blue allocated so that other fields 20B parallel to the field 20R in the synthetic prism 20 might be countered.

Each video display light valves 21R, 21G, and 21B correspond to the space modulation means in this invention.

[0043]A graphic display device is further allocated in the side of each video display light valves 21R, 21G, and 21B, It has the red light device 22R for irradiating each video display light valves 21R, 21G, and 21B with red light light, green illumination-light, and blue light light, respectively, the green lighting system 22G, and the blue light device 22B. The red light device 22R joins the red light diode 11R to the incident end face of the kaleidoscope 12R. Similarly, the green lighting system 22G joins the green light emitting diode 11G to the incident end face of the kaleidoscope 12G, and the blue light device 22B joins the blue light-emitting diode 11B to the incident end face of the kaleidoscope 12B. The thing of which gestalt of the 1st thru/or the 4th embodiment may be sufficient as each lighting systems 22R, 22G, and 22B.

[0044]Between the red light device 22R and the video display light valves 21R for red, the relay lens 23R for red and the field lens 24R for red are allocated in order from the red light device 22R side. Similarly, between the green lighting system 22G and the video display light valves 21G for green, the relay lens 23G for green and the field lens 24G for green are allocated in order from the green lighting-system 22G side. Between the blue light device 22B and the video display light valves 21B for blue, the relay lens 23B for blue and the field lens 24B for blue are allocated in order from the blue light device 22B side. A graphic display device is allocated so that the field 20A still more nearly parallel to the field 20G in the synthetic prism 20 may be countered, It was formed of each video display light valves 21R, 21G, and 21B, and has the projector lens 25 for projecting the light of the picture combined by the synthetic prism 20 on the screen 26 of a transmission type (in the case of a back projection type graphic display device), or a reflection type (in the case of a front projection type graphic display device). Each above-mentioned component in a graphic display device is held by a suitable holder, and is installed in the case which is not illustrated.

[0045]The synthetic prism 20 comprises a dichroic prism which has the reflector 20r which reflects in the field 20A side only the red light which entered from the field 20R, and the reflector 20b which reflects in the field 20A side only the blue glow which entered from the field 20B.

[0046]The video display light valves 21R, 21G, and 21B have a pixel of controllable a large number for the transmissivity of light, respectively. As the video display light valves 21R, 21G, and 21B, For example, the transmission type liquid crystal light valve using TFT (Thin Film Transistor; thin film transistor) as a switch

element is used, using the liquid crystal of TN (Twisted Nematic; twist pneumatic) mold as a liquid crystal.
[0047]The relay lenses 23R, 23G, and 23B An image respectively two-dimensional in the emitting end surface of each kaleidoscopes 12R, 12G, and 12B, Namely, are the image of a secondary light source a lens for carrying out image formation on each video display light valves 21R and 21G and 21B, and the field lenses 24R, 24G, and 24B, Respectively, it is a lens for carrying out image formation of the image of the backside focal plane of the relay lenses 23R, 23G, and 23B to the position of the entrance pupil of the projector lens 25. As the projector lens 25, the thing near telecentric system is used, for example.
[0048]As for the shape of the light-emitting surface of the light emitting diodes 11R, 11G, and 11B, and the section of the kaleidoscopes 12R, 12G, and 12B, it is preferred to consider it as the shape of the image display area of the video display light valves 21R, 21G, and 21B and similar figures.
[0049]Drawing 16 is a block diagram showing the circuitry of the graphic display device concerning this embodiment. As shown in this figure, the graphic display device concerning this embodiment is provided with the following.
The video signal processing circuit 31 which inputs video-signal VS and generates the picture signal for red corresponding to a red image, a green image, and a blue image, the picture signal for green, and the picture signal for blue, respectively.
The image memory 32R for red for recording temporarily the picture signal for red, the picture signal for green, and the picture signal for blue which were generated by this video signal processing circuit 31, the image memory 32G for green, the image memory 32B for blue.
The light valve drive circuit 33R for red which is connected to the video signal processing circuit 31 and the image memory 32R for red, and drives the video display light valves 21R for red.
The light valve drive circuit 33G for green which is connected to the video signal processing circuit 31 and the image memory 32G for green, and drives the video display light valves 21G for green, The light valve drive circuit 33B for blue which is connected to the video signal processing circuit 31 and the image memory 32B for blue, and drives the video display light valves 21B for blue.

[0050]A graphic display device is provided with the following.
The red light diode drive circuit 34R, the green light emitting diode drive circuit 34G, the blue light-emitting diode drive circuit 34B which drive the red light diode 11R, the green light emitting diode 11G, and the blue light-emitting diode 11B (a light emitting diode is described as LED by a diagram.), respectively.
The controller 35 which controls the video signal processing circuit 31 and each light emitting diode drive circuits 34R, 34G, and 34B.
The controller 35 is constituted by the microcomputer, for example.
[0051]The means which enables independently regulation of the luminosity of the light emitted by changing the driving current of each light emitting diodes 11R, 11G, and 11B by a variable resistor etc. from each light emitting diodes 11R, 11G, and 11B is formed in each light emitting diode drive circuits 34R, 34G, and 34B.
[0052]Next, an operation of the graphic display device concerning this embodiment is explained. As shown in drawing 2, video-signal VS is inputted into the video signal processing circuit 31, and the picture signal for red, the picture signal for green, and the picture signal for blue are generated by this video signal processing circuit 31, and it is once recorded on the image memory 32R for red, the image memory 32G for green, and the image memory 32B for blue, respectively. Each light valve drive circuits 33R, 33G, and 33B are fixed cycles, from each image memories 32R, 32G, and 32B, read the picture signal for each colors, and drive each video display light valves 21R, 21G, and 21B based on this picture signal, respectively.
[0053]On the other hand, each light emitting diode drive circuits 34R, 34G, and 34B drive each light emitting diodes 11R, 11G, and 11B so that each light emitting diodes 11R, 11G, and 11B may always light up.
[0054]As shown in drawing 15, the red illumination light which was emitted from the red light diode 11R and, as for, entropy was carried out by the kaleidoscope 12R, Through the relay lens 23R and the field lens 24R, the video display light valves 21R for red glare, and intensity modulation is spatially carried out by the video display light valves 21R for red, and it enters into the synthetic prism 20 by them. The green illumination light which was emitted from the green light emitting diode 11G and similarly, as for, entropy was carried out by the kaleidoscope 12G, Through the relay lens 23G and the field lens 24G, the video display light valves 21G for green glare, and intensity modulation is spatially carried out by the video display light valves 21G for green, and it enters into the synthetic prism 20 by them. The blue illumination light which was emitted from the blue light-emitting diode 11B and, as for, entropy was carried out by the kaleidoscope 12B, Through the relay lens 23B and the field lens 24B, the video display light valves 21B for blue glare, and intensity modulation is spatially carried out by the video display light valves 21B for blue, and it enters into the synthetic prism 20 by them.
[0055]The light of each color modulated by each video display light valves 21R, 21G, and 21B is compounded by

the synthetic prism 20, and it is emitted from the field 20A, and with the projector lens 25, extended projection is carried out to the screen 26, and a color video image is displayed on the screen 26.

[0056]Drawing 17 The kaleidoscope 12 (12R, 12G, and 12B are represented.), It is an explanatory view showing the state of the light in the kaleidoscope illumination system containing the relay lens 23 (23R, 23G, and 23B are represented.) and the field lens 24 (24R, 24G, and 24B are represented.). As shown in this figure, the image of the emitting end surface of the kaleidoscope 12, With the field lens 23, image formation is carried out to the video display light valves 21 (21R, 21G, and 21B are represented.) which are illumination parts, and, thereby, the illumination light to which entropy of the illumination was carried out is irradiated on the video display light valves 21. The field lens 24 carries out image formation of the image of the backside focal plane of the relay lens 23 to the position 28 of the entrance pupil of the projector lens 25.

[0057]With the graphic display device concerning this embodiment, as explained above, since the light emitting diode was used as a light source, the life of a light source becomes long and the time and effort of exchange of a light source can be reduced. Since the wavelength area of the emitted light of the light emitting diodes 11R, 11G, and 11B for every color is narrow, The wavelength distribution of each color is not dependent on the wavelength distribution of the emitted light of the original white light source like [at the time of carrying out color separation of the emitted light of a white light source], the range of the color which can be expressed by composition of the emitted light of each light emitting diodes 11R, 11G, and 11B becomes large, and, as a result, good color reproduction becomes possible.

[0058]Compared with a white light source, a light emitting diode has little power consumption, and it is small. By using a light emitting diode as a light source, the light thrown away when carrying out color separation like [in the case of using a white light source as a light source] is lost, and the utilization efficiency of light can be improved. as a result, power consumption can be lessened compared with the case where a white light source is used as a light source -- the miniaturization of a graphic display device is both attained.

[0059]According to the graphic display device concerning this embodiment, since entropy of illumination is attained through the kaleidoscope 12, the emitted light of the light emitting diode 11, Generating of luminosity unevenness or an irregular color can be prevented, the display luminance of the video display light valves 21 can be equalized, and display quality can be raised.

[0060]By making shape of the light-emitting surface of the light emitting diode 11, and the section of the kaleidoscope 12 into the shape of the image display area of the video display light valves 21, and similar figures in the graphic display device concerning this embodiment, Sectional shape of the light flux irradiated by the image formation area can be made into the shape corresponding to the shape of an image formation area, the utilization efficiency of light improves compared with the case where the section of light flux uses the white light source which becomes circular, and, as a result, reduction of power consumption and the miniaturization of a device are attained further.

[0061]Since the luminosity of the light emitted from the light emitting diodes 11R, 11G, and 11B for every color can be adjusted independently according to the graphic display device concerning this embodiment, as compared with the former, the region of accommodation of a color becomes large. When the efficiency of the light emitting diodes 11R, 11G, and 11B for every color differs, Beforehand in each light emitting diode drive circuits 34R, 34G, and 34B, The luminosity of the light emitted by changing the driving current of each light emitting diodes 11R, 11G, and 11B etc. from each light emitting diodes 11R, 11G, and 11B is adjusted independently, and it becomes possible to double the color temperature of a white screen with a predetermined value. An appreciation person adjusts arbitrarily the luminosity of the light emitted from each light emitting diodes 11R, 11G, and 11B, and it also becomes possible to perform the color adjustment suitable for the appreciation person's taste. In the graphic display device concerning this embodiment. Since the luminosity of the light emitted from each light emitting diodes 11R, 11G, and 11B can be adjusted independently, regulation of the luminosity for every color is attained making the same the emission area of the light emitting diodes 11R, 11G, and 11B for every color, and, as a result, the optical system of a graphic display device can be simplified.

[0062]Next, with reference to drawing 18 thru/or drawing 20, the graphic display device concerning a 7th embodiment of this invention is explained. Drawing 18 is an explanatory view showing the composition of the graphic display device concerning this embodiment. The graphic display device concerning this embodiment is the example which displayed the color picture with the time sharing color specification method. The graphic display device concerning this embodiment has formed the video display light valves 41 between the synthetic prism 20 and the projector lens 25 instead, without forming the video display light valves 21R, 21G, and 21B for every [in a 6th embodiment] color.

[0063]Drawing 19 is a block diagram showing the circuitry of the graphic display device concerning this embodiment. The graphic display device concerning this embodiment is provided with the following.

The video signal processing circuit 42 which inputs video-signal VS, generates the picture signal for red

corresponding to a red image, a green image, and a blue image, the picture signal for green, and the picture signal for blue, respectively, switches these one by one and outputs them.
The image memory 43 for recording temporarily the picture signal for red, the picture signal for green, and the picture signal for blue which were generated by this video signal processing circuit 42.
The light valve drive circuit 44 which is connected to the video signal processing circuit 42 and the image memory 43, and drives the video display light valves 41.

[0064]A graphic display device is provided with the following.
The red light diode drive circuit 34R, the green light emitting diode drive circuit 34G, the blue light-emitting diode drive circuit 34B which drive the red light diode 11R, the green light emitting diode 11G, and the blue light-emitting diode 11B (a light emitting diode is described as LED by a diagram.), respectively.
The controller 35 which controls the video signal processing circuit 42, the light valve drive circuit 44, and each light emitting diode drive circuits 34R, 34G, and 34B.

[0065]Next, with reference to the timing chart of drawing 20, operation of the graphic display device concerning this embodiment is explained. The controller 35 inputs video-signal VS, synchronizes with this video signal, generates the timing signal for dividing the period of one frame or the 1 field into three equally, and sends it to the video signal processing circuit 42 and the light valve drive circuit 44. According to this timing signal, the video signal processing circuit 44 generates the picture signal for red, the picture signal for green, and the picture signal for blue, switches these one by one and outputs them. This picture signal is once recorded on the image memory 43. According to the timing signal from the controller 35, from the image memory 43, the light valve drive circuit 44 reads the picture signal for each colors one by one, and drives the video display light valves 41 based on this picture signal. As a result, at the video display light valves 41, as shown in drawing 20 (d), in the period of one frame or the 1 field, each gradation images for red (R) green (G) and blue (B) are switched one by one, and are displayed.
[0066]On the other hand, in the video display light valves 41, synchronizing with red, green, and the timing as which each gradation images for blue are displayed, the controller 35 controls each light emitting diode drive circuits 34R, 34G, and 34B so that the light emitting diodes 11R, 11G, and 11B light up one by one. As a result, as shown in drawing 20 (a) - (c), it synchronizes with red, green, and the timing as which each gradation images for blue are displayed in the video display light valves 41, The light emitting diodes 11R, 11G, and 11B (drawing 20 describes LED R, LED G, and LED B, respectively.) light up, and the light of each color is switched one by one, and is irradiated by the video display light valves 41.
[0067]Although red and each green and blue picture are switched one by one by such operation and it is projected on them by the screen 26 by it, it is recognized by the appreciation person as a color picture by the afterimage effect of human being's eyes. The composition of others in this embodiment, the operation, and the effect are the same as that of a 6th embodiment.
[0068]Next, with reference to drawing 21 and drawing 22, the graphic display device concerning an 8th embodiment of this invention is explained. A time sharing color specification method is used for the graphic display device concerning this embodiment like a 7th embodiment, and it is the example which displayed the color picture using the digital gradation display type.
[0069]The principle of a digital gradation display type is explained with reference to introduction and drawing 21. The principle of a digital gradation display type is expressing a picture to display as shown in drawing 21 (a) as the sum of two or more bit images (binary format image) which carried out weighting as shown in drawing 21 (b) - (e). The upper row of drawing 21 (a) expresses the example of gradation images to display, and the upper row of drawing 21 (b) - (e) expresses each bit image by which weighting was carried out to 8:4:2:1. Drawing 21 (a) The lower berth of - (e) expresses the luminosity of each pixel in the picture of the upper row with a hexadecimal number. The bit image group which carried out weighting is displayed, and an appreciation person is made to sense gradation in the time of one frame in this digital gradation display type using the afterimage effect of human being's eyes by control of the video display light valves for a light source and binary displays.
[0070]There are mainly two methods in weighting of the bit image in a digital gradation display. It is the optical-intensity-modulation gradation display which one sets the luminosity of the illumination light constant, it is the Pulse-Density-Modulation gradation display which carries out weighting with the length of the display time of each bit image, and other one sets constant the length of the display time of each bit image, and carries out weighting with the luminosity of the illumination light. It is also possible to use two methods together.
[0071]What is necessary is for a binary display to be just possible for the light emitting diodes 11R, 11G, and 11B, although the composition of the graphic display device concerning this embodiment is the same as that of what was shown in drawing 19, and abbreviation.

[0072]Next, with reference to the timing chart of drawing 22, operation of the graphic display device concerning this embodiment is explained. Drawing 22 (a) – (c) expresses the light-emitting timing and light quantity of the light emitting diode, respectively. Drawing 22 (d) expresses the displaying condition of the video display light valves 41. Here, the example for using together a Pulse-Density-Modulation gradation display and an optical-intensity-modulation gradation display, and performing a digital gradation display is explained. Each bit image by which weighting was carried out to 8:4:2:1 in the following explanation in order to express red gradation images, Each bit image by which weighting was carried out to 8:4:2:1 in order to be referred to as the picture R8, R4, R2, and R1, respectively and to express green gradation images, It is referred to as the picture G8, G4, G2, and G1, respectively, and each bit image by which weighting was carried out to 8:4:2:1 in order to express blue gradation images is set to the picture B8, B4, B-2, and B1, respectively.
[0073]The controller 35 inputs video-signal VS, generates the predetermined timing signal in sync with this video-signal VS, and sends it to the video signal processing circuit 42 and the light valve drive circuit 44. According to this timing signal, for every frame, the video signal processing circuit 42 generates the bit image R8, G8, B8, R4, R2, R1, G4, G2, G1, B4, B-2, and the picture signal of B1, switches these one by one and outputs them. This picture signal is once recorded on the image memory 43. According to the timing signal from the controller 35, from the image memory 43, the light valve drive circuit 44 reads the picture signal of each bit image one by one, and drives the video display light valves 44 based on this picture signal. In this embodiment, as shown in drawing 22 (d), divide the period of 2/5 into three equally from the head in one frame, and the bit image R8, G8, and B8 are displayed one by one, He divides the remaining periods in one frame into nine equally, and is trying to display the bit image R4, R2, R1, G4, G2, G1, B4, B-2, and B1 one by one. Therefore, the period when the bit image R8, G8, and B8 are displayed becomes twice a period when other bit images are displayed.
[0074]As shown in drawing 22 (a) – (c), the controller 35, In the video display light valves 41, synchronizing with red, green, and the timing as which each bit image for blue is displayed, each light emitting diode drive circuits 34R, 34G, and 34B are controlled so that the light emitting diodes 11R, 11G, and 11B light up one by one. The controller 35 the period when the bit image R8, G8, and B8 are displayed and the period when the bit image R4, G4, and B4 are displayed, When the light quantity of the light emitting diodes 12R, 12G, and 12B is equal and sets light quantity at this time to 1, The period when 1/2, the bit image R1, G1, and B1 are displayed for light quantity in the period when the bit image R2, G2, and B-2 are displayed controls each light emitting diode drive circuits 34R, 34G, and 34B so that light quantity is set to one fourth. By such operation, within one frame, it is projected on the light of two or more bit images by which weighting was carried out to 8:4:2:1 for every color one by one at the screen 26, and it is recognized by the afterimage effect of human being's eyes as a color picture at an appreciation person. The composition of others in this embodiment, the operation, and the effect are the same as that of a 7th embodiment. Several microseconds and since the speed of response of a light emitting diode is quick, the color image display using a time sharing color specification method like a 7th or 8th embodiment of it becomes possible.
[0075]Drawing 23 is an explanatory view showing the composition of the graphic display device concerning a 9th embodiment of this invention. The graphic display device concerning this embodiment is the example which uses a reflection type liquid crystal light valve as video display light valves, and displayed the color picture using the time sharing color specification method. In the graphic display device which showed drawing 18 the graphic display device concerning this embodiment, Form the dichroic mirror section 50 instead of the synthetic prism 20, and instead of the field lenses 24R, 24G, and 24B, The field lens 51 is formed in the outgoing radiation side of the dichroic mirror section 50, and the polarization beam splitter 60 and the video display light valves 61 which use a reflection type liquid crystal light valve are formed instead of the video display light valves 41 which use the liquid crystal light valve of further a transmission type.
[0076]The dichroic mirror 50R in which the dichroic mirror section 50 reflects only the red light from the lighting system 22R in the field lens 51 side, It is constituted by joining the dichroic mirror 50B which reflects only the blue glow from the lighting system 22B in the field lens 51 side in a mutual center portion.
[0077]The polarization beam splitter 60 and the video display light valves 61 are allocated in this order on the optical path of the emitted light of the field lens 51. The polarization beam splitter 60 penetrates P polarization (a polarization direction is parallel polarization to an entrance plane), and has the reflector 60a in which S polarization (a polarization direction is vertical polarization to an entrance plane) is reflected. According to this embodiment, the projector lens 25 is allocated in the direction in which the light from the video display light valves 61 reflects and advances in the reflector 60a of the polarization beam splitter 60.
[0078]As the video display light valves 61, the high-reflective-liquid-crystal light valve using the double reflex of the liquid crystal is used, for example. As a high-reflective-liquid-crystal light valve, specifically, For example, poly-Si TFT and amorphous TFT which were produced on the glass substrate, Or the high-reflective-liquid-crystal panel using the substrate incorporating circuits produced on crystalline silicon, such as CMOS (CMOS)

and SRAM (static random access memory), can be used. As a liquid crystal which has a double reflex, a pneumatic liquid crystal, a ferroelectric liquid crystal, etc. can be used.

[0079]In the graphic display device concerning this embodiment, the light emitting diodes 11R, 11G, and 11B and the video display light valves 61 are driven like a 7th or 8th embodiment according to a time sharing color specification method. The light emitted from each light emitting diodes 11R, 11G, and 11B enters into the polarization beam splitter 60 through the relay lenses 23R, 23G, and 23B, the dichroic mirror section 50, and the field lens 51. In the polarization beam splitter 60, only P polarization component of the lights which entered penetrates the reflector 60a, and enters into the video display light valves 61. By changing a polarization condition (polarization degree) for every pixel according to the picture which displays the light which entered using a double reflex, it becomes irregular spatially and the video display light valves 61 which use a reflection type liquid crystal light valve are reflected in the polarization beam splitter 60 side. In the polarization beam splitter 60, it is reflected in the reflector 60a, only S polarization component of the lights from the video display light valves 61 enters into the projector lens 25, and extended projection is carried out to the screen 26 of a transmission type or a reflection type. The composition of others in this embodiment, the operation, and the effect are the same as that of a 7th or 8th embodiment.

[0080]Drawing 24 is an explanatory view showing the composition of the graphic display device concerning a 10th embodiment of this invention. The graphic display device concerning this embodiment is the example which provided the video display light valves which use a reflection type liquid crystal light valve for every color. This graphic display device is provided with the red light device 22R, the relay lens 23R for red, the field lens 24R for red, the polarization beam splitter 71 for red, and the video display light valves 61R for red which were allocated on the straight line. These are arranged so that S polarization component reflected in the reflector 71a of the polarization beam splitter 71 for red among the lights reflected by the video display light valves 61R for red may enter into the field 20R of the synthetic prism 20. The graphic display device is further provided with the green lighting system 22G, the relay lens 23G for green, the field lens 24G for green, the polarization beam splitter 72 for green, and the video display light valves 61G for green which were allocated on the straight line. These are arranged so that S polarization component reflected in the reflector 72a of the polarization beam splitter 72 for green among the lights reflected by the video display light valves 61G for green may enter into the field 20G of the synthetic prism 20. The graphic display device is further provided with the blue light device 22B, the relay lens 23B for blue, the field lens 24B for blue, the polarization beam splitter 73 for blue, and the video display light valves 61B for blue which were allocated on the straight line. These are arranged so that S polarization component reflected in the reflector 73a of the polarization beam splitter 73 for blue among the lights reflected by the video display light valves 61B for blue may enter into the field 20G of the synthetic prism 20.

[0081]The principle of the abnormal conditions by each polarization beam splitters 71, 72, and 73 and the video display light valves 61R, 61G, and 61B is as having explained in a 9th embodiment. Like a 1st embodiment, the light modulated for every color is compounded by the synthetic prism 20, and it is projected on it by the screen 26 with the projector lens 25. The composition of others in this embodiment, the operation, and the effect are the same as that of a 6th embodiment.

[0082]Drawing 25 is an explanatory view showing the composition of the graphic display device concerning an 11th embodiment of this invention. The graphic display device concerning this embodiment is provided with the lighting system 75, the relay lens 76, the field lens 77, the polarization beam splitter 60, and the video display light valves 61 which were allocated on the straight line. The polarization beam splitter 60 penetrates P polarization, and has the reflector 60a in which S polarization is reflected. According to this embodiment, the projector lens 25 is allocated in the direction in which the light from the video display light valves 61 reflects and advances in the reflector 60a of the polarization beam splitter 60.

[0083]As shown in drawing 12 thru/or drawing 14, to the incident end face of the kaleidoscope 12, the lighting system 75 in this embodiment arranges two or more red light diodes 11R, green light emitting diodes 11G, and blue light-emitting diodes 11B every, respectively, and is joined.

[0084]In the graphic display device concerning this embodiment, the trichromatic illumination light of R, G, and B which entropy of the illumination is carried out, respectively and are outputted one by one can be obtained by making each light emitting diodes 11R, 11G, and 11B in the lighting system 75 turn on one by one. And the display of the color picture by a time sharing color specification method is attained like a 9th embodiment using the trichromatic illumination light of this R, G, and B. The composition of others in this embodiment, the operation, and the effect are the same as that of a 9th embodiment.

[0085]Drawing 26 is an explanatory view showing the composition of the graphic display device concerning a 12th embodiment of this invention. The graphic display device concerning this embodiment is an example of an image display type graphic display device, and has the so-called gestalt of a head mount display. This graphic display device is provided with the lighting system 75 allocated on the straight line, the relay lens 81, and the

transmission type video display light valves 82. The graphic display device concerning this embodiment is provided with the following.
The half mirror 83 allocated on the optical path of the emitted light from the video display light valves 82.
The concave mirror 84 which served as the half mirror allocated on the optical path of the light which is emitted from the video display light valves 82, and is reflected by the half mirror 83.
Each above-mentioned component is held by a suitable holder, and is installed in the case. Like an 11th embodiment, as shown in drawing 12 thru/or drawing 14, to the incident end face of the kaleidoscope 12, the lighting system 75 arranges two or more red light diodes 11R, green light emitting diodes 11G, and blue light-emitting diodes 11B every, respectively, and is joined.
[0086]In the graphic display device concerning this embodiment, the trichromatic illumination light of R, G, and B which entropy of the illumination is carried out, respectively and are outputted one by one can be obtained by making each light emitting diodes 11R, 11G, and 11B in the lighting system 75 turn on one by one. This trichromatic illumination light is spatially modulated one by one by the video display light valves 82. A part is reflected by the half mirror 83, it enters into the concave mirror 84, a part is reflected here, and the modulated light enters into the half mirror 83, and further, a part penetrates the half mirror 83 and it is projected on it by an observer's eyes 85. By this, an observer will observe the virtual image 86 which was generated by the video display light valves 82, and was expanded with a front scene.
[0087]In the graphic display device which has a gestalt of a head mount display, the lighting system which can give the small and uniform illumination light is required. In the graphic display device concerning this embodiment, the lighting system 75 which has the light emitting diodes 11R, 11G, and 11B and the kaleidoscope 12 is used as such a lighting system. Therefore, the miniaturization of a graphic display device is attained and the quality of an image can be raised by the uniform illumination light. The composition of others in this embodiment, the operation, and the effect are the same as that of an 11th embodiment.
[0088]Drawing 27 is an explanatory view showing the composition of the graphic display device concerning a 13th embodiment of this invention. This embodiment is the example which applied this invention to the exposure device for carrying out projection exposure of the mask pattern (it corresponds to the image in this invention.) to the photoresist on a semiconductor wafer. The exposure device concerning this embodiment is provided with the following.
Lighting system 91.
The condensing lens 92 with which the mask 93 (it corresponds to the space modulation means in this invention.) which condensed the emitted light of this lighting system 91, and in which the predetermined pattern was formed is irradiated.
The projection lens 94 which projects the light after mask 93 passage on the photoresist on the semiconductor wafer 95.
The lighting system 91 may join the light emitting diode 11 to the incident end face of the kaleidoscope 12, and the thing of which gestalt of the 1st thru/or the 4th embodiment may be sufficient as it. In this embodiment, the light emitting diode 11 shall emit the light (visible light and ultraviolet radiation) which has sensitivity to photoresist.
[0089]In this exposure device, the light emitted from the lighting system 91 is irradiated by the mask 93 through the condensing lens 92. The light spatially modulated with the mask 93 is projected on the photoresist on the semiconductor wafer 95 with the projection lens 94, and photoresist is exposed. The exposure device which performs actual size exposure may be sufficient as the exposure device concerning this embodiment, and the stepping projection aligner which performs reduced projection exposure may be sufficient as it.
[0090]Since the lighting system 91 which joined the light emitting diode 11 was used for the incident end face of the kaleidoscope 12 as a light source according to the exposure device concerning this embodiment, The life of a light source becomes long, and the utilization efficiency of light can be improved, power consumption can be lessened and the miniaturization of an exposure device is attained. To the mask 93, illumination can irradiate with the illumination light by which entropy was carried out, and can raise the accuracy of exposure.
[0091]This invention is not limited to each above-mentioned embodiment, for example, may use a fly eye lens instead of a kaleidoscope as an illumination entropy optical element in the 6th thru/or a 12th embodiment. A fly eye lens is a lens of the array form which put the small lens in order (refer to the 41-44th page" in above literature " "opto-electronics contact" and Vol.33 No 2-1995 years.).
[0092]The side view and drawing 29 in which an example of the lighting system with which drawing 28 has arranged two or more light emitting diodes to the incident end face of a fly eye lens is shown are a sectional view of the fly eye lens in drawing 28. As shown in these figures, the fly eye lens 100 puts many small lenses 101 in order, and is constituted. In the example shown in drawing 28, two or more light emitting diodes 11 are arranged to the incident end face of the fly eye lens 100. With the light-emitting surface of each light emitting diode 11, the

reflector 111 of shape which makes a part of surface of a sphere is formed in the field side of an opposite hand, respectively. Ahead of the light-emitting surface of each light emitting diode 11, the lens 112 is formed, respectively. The light emitting diode 11, the reflector 111, and the lens 112 of these plurality are arranged so that the light-emitting surface of the light emitting diode 11 may counter the incident end face of the fly eye lens 100. A lighting system as shown in drawing 28 can be replaced with the lighting system in the 6th thru/or a 13th embodiment.

[0093]As a space modulation means, the liquid crystal light valve using not only the thing quoted by the embodiment but a ferroelectric liquid crystal or a polymers distribution liquid crystal may be sufficient, further, it is a pixel unit, and reflection of light, a penetration, diffraction, etc. may be controlled by mechanical operation, and light may be modulated spatially.

[0094]Although what emits red light, green light, and blue glow was used as a light emitting diode in the 6th thru/or a 12th embodiment, what emits the light of other colors may be used. In this case, it is made to drive video display light valves based on the chrominance signal corresponding to the color of the emitted light of a light emitting diode.

[0095]

[Effect of the Invention]As explained above, according to the lighting system according to any one of claims 1 to 5. Since it was made to irradiate an illumination part with the light emitted from the light source using one or more light emitting diodes by it as entropy of the illumination in an illumination part was carried out by the illumination entropy optical element, The life of a light source becomes long, reduction of power consumption and the miniaturization of a device are attained, and the effect that entropy of the illuminance distribution can be carried out is further done so.

[0096]Since according to the lighting system according to claim 4 two or more light emitting diodes are formed so that each light-emitting surface may be arranged superficially, and each luminescence intensity was controlled independently, In addition to the effect of the lighting system according to claim 1, the effect of becoming possible to obtain the more uniform illumination light is done so by giving distribution to the luminescence intensity of a light source.

[0097]According to the graphic display device according to any one of claims 6 to 12, the entropy of the illumination in a space modulation means is made to carry out the light emitted from the light source using one or more light emitting diodes by the illumination entropy optical element, Since a space modulation means is irradiated, and it becomes irregular spatially according to the information on the image displayed by a space modulation means and was made to project according to a projection optical system, The life of a light source becomes long, reduction of power consumption and the miniaturization of a device are attained, still better color reproduction becomes possible, and the effect that display luminance can be equalized is done so.

[0098]Since according to the graphic display device according to claim 9 two or more light emitting diodes are formed so that each light-emitting surface may be arranged superficially, and each luminescence intensity was controlled independently, In addition to the effect of the graphic display device according to claim 6, the more uniform illumination light is obtained and the effect of becoming possible to equalize display luminance more is done so.

[0099]Since a light source constitutes a color picture according to the graphic display device according to claim 11, Including two or more light emitting diodes which emit the light of a mutually different wavelength area, by a driving means with a predetermined cycle. Since it was made to drive two or more light emitting diodes so that the light of a mutually different wavelength area may be emitted one by one, in addition to the effect of the graphic display device according to claim 6, the display of the color picture by a time sharing color specification method is attained.

[0100]Since the end face by the side of outgoing radiation of the rod type light integrator as an illumination entropy optical element was formed in the shape corresponding to the image formation area in a space modulation means according to the graphic display device according to claim 12, In addition to the effect of the graphic display device according to claim 6, the effect that the utilization efficiency of light can be raised is done so.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1]It is a perspective view showing the composition of the lighting system concerning a 1st embodiment of this invention.
[Drawing 2]It is a perspective view showing the modification of the lighting system shown in drawing 1.
[Drawing 3]It is a sectional view showing an example of the joining section of the light emitting diode and kaleidoscope in the lighting system concerning a 1st embodiment of this invention.
[Drawing 4]It is a sectional view showing other examples of the joining section of the light emitting diode and kaleidoscope in the lighting system concerning a 1st embodiment of this invention.
[Drawing 5]It is an explanatory view for explaining the principle of the illumination entropy in a kaleidoscope.
[Drawing 6]It is a perspective view showing the composition of the lighting system concerning a 2nd embodiment of this invention.
[Drawing 7]It is a perspective view showing the composition of the lighting system concerning a 3rd embodiment of this invention.
[Drawing 8]It is a perspective view showing the composition of the lighting system concerning a 4th embodiment of this invention.
[Drawing 9]It is an explanatory view showing the result of the experiment which investigated the relation between the luminescent state of a light source, and the illumination state in an illumination part.
[Drawing 10]It is an explanatory view showing the result of the experiment which investigated the relation between the luminescent state of a light source, and the illumination state in an illumination part.
[Drawing 11]It is an explanatory view showing the example of the illuminance distribution in the luminescent state and video display light valves of a light source.
[Drawing 12]It is a perspective view showing the composition of the lighting system concerning a 5th embodiment of this invention.
[Drawing 13]It is an explanatory view showing an example of the method of the arrangement of the light emitting diode in drawing 12.
[Drawing 14]It is an explanatory view showing other examples of the method of the arrangement of the light emitting diode in drawing 13.
[Drawing 15]It is an explanatory view showing the composition of the graphic display device concerning a 6th embodiment of this invention.
[Drawing 16]It is a block diagram showing the circuitry of the graphic display device concerning a 6th embodiment of this invention.
[Drawing 17]It is an explanatory view showing the state of the light in the kaleidoscope illumination system of the graphic display device concerning a 6th embodiment of this invention.
[Drawing 18]It is an explanatory view showing the composition of the graphic display device concerning a 7th embodiment of this invention.
[Drawing 19]It is a block diagram showing the circuitry of the graphic display device concerning a 7th embodiment of this invention.
[Drawing 20]It is an explanatory view showing operation of the graphic display device concerning a 7th embodiment of this invention.
[Drawing 21]It is an explanatory view for explaining the principle of the digital gradation display type used in the graphic display device concerning an 8th embodiment of this invention.
[Drawing 22]It is an explanatory view showing operation of the graphic display device concerning an 8th embodiment of this invention.
[Drawing 23]It is an explanatory view showing the composition of the graphic display device concerning a 9th embodiment of this invention.

[Drawing 24]It is an explanatory view showing the composition of the graphic display device concerning a 10th embodiment of this invention.
[Drawing 25]It is an explanatory view showing the composition of the graphic display device concerning an 11th embodiment of this invention.
[Drawing 26]It is an explanatory view showing the composition of the graphic display device concerning a 12th embodiment of this invention.
[Drawing 27]It is an explanatory view showing the composition of the graphic display device concerning a 13th embodiment of this invention.
[Drawing 28]It is a side view showing an example of the lighting system which can be replaced with the lighting system in the 6th thru/or a 13th embodiment of this invention.
[Drawing 29]It is a sectional view of the fly eye lens in drawing 28.
[Description of Notations]
11, 11R, 11G, 11B -- A light emitting diode, 12, 12R, 12G, 12B -- Kaleidoscope, 20 [-- A field lens, 25 / -- Projector lens.] -- A synthetic prism, 21R, 21G, 21B -- Video display light valves, 23R, 23G, 23B -- A relay lens, 24R, 24G, 24B

[Translation done.]